REMARKS

Applicants have studied the Office Action dated July 29, 2004 and have made amendments to the claims. Claims 1-25 are pending. Claims 10 and 23 have been amended. It is submitted that the application, as amended, is in condition for allowance. Reconsideration and allowance of the pending claims in view of the above amendments and the following remarks is respectfully requested.

In the Office Action, the Examiner:

(1) objected to the disclosure;

(3) rejected claim 10 under 35 U.S.C. 112, second paragraph;

(5) rejected claims 1-25 under the judicially created doctrine of obviousness-type double patenting;

(6) rejected claims 1-6, 8-14 and 20-22 under 35 U.S.C. §103(a) as anticipated by or unpatentable over Polanyi et al. (U. S. Patent No. 6,319,566) in view of Morishige (U. S. Patent No. 4,711,790);

(7) rejected claims 23, 24 and 25 under 35 U.S.C. §103(a) as being unpatentable over Polanyi et al., optionally in view of Morishige, and further in view of Trushin et al.; and

(8) rejected claim 7 under 35 U.S.C. §103(a) as being unpatentable over Polanyi et al. in view of Morishige and Baum et al. (U. S. Patent No. 5,407,710), and optionally in view of Baum et al. '206.

Objection to Disclosure Due to Informalities

The disclosure has been amended to include the patent number of the parent case. Accordingly, Applicants respectfully request that the objection to the disclosure be withdrawn.

Rejection Under 35 U.S.C. 112, Second Paragraph

The Examiner rejected claim 10 under 35 U.S.C. 112, second paragraph. Applicants have amended claim 10 to specify that the film is "a few monolayers thick." Accordingly, Applicants respectfully request that the rejection of claim 10 under 35 U.S.C. 112, second paragraph, be withdrawn.

Rejection Under the Judicially Created Doctrine of Double Patenting

Claims 1-25 were rejected under the judicially created doctrine of obviousness-type double patenting. Applicants believe there is no double patenting with the present invention in view of claims 1-24 of U.S. Patent No. 6,656,539 because the present invention is patentably distinct. In order to further prosecution, however, a terminal disclaimer is submitted herewith. Accordingly, the Examiner is respectfully requested to withdraw the rejection under the judicially created doctrine of obviousness-type double patenting.

Overview of the Present Invention

Preferred embodiments of the present invention provide a method and system for depositing material, such as metals, onto a substrate. These embodiments use a two stage process in which donor molecules are carried in vapor form over a substrate so that a layer of those donor molecules is adsorbed onto the surface of the substrate. The adsorbed donor molecules are decomposed using short bursts of focused, high intensity light energy, as described in detail in the specification.

Claim Amendments

Applicants have amended claim 23 to more clearly specify that "the optical radiation has a pulse width that is insufficient to cause thermal absorption by the element so as to prevent thermally induced breakdown of the donor compound." This amendment merely changes the wording of this limitation to improve clarity. As described above, Applicants have also amended claim 10 for clarity.

Rejections Under 35 U.S.C. §103(a) as being unpatentable over Polanyi et al. in view of Morishige et al.

The Examiner rejected claims 1-6, 8-14 and 20-22 under 35 U.S.C. §103(a) as being unpatentable over Polanyi et al. in view of Morishige et al. The Examiner relies on 35 U.S.C. §103, which expressly requires that obviousness or non-obviousness be determined for the claimed subject matter "as a whole." The key to proper determination of the differences between the cited reference and the present invention is giving full recognition to the invention "as a whole."

To begin, the Polanyi et al. reference is directed to molecular-scale pattern imprinting at surfaces. The method of Polanyi places an adsorbate that is arranged into a pre-existent molecular-scale pattern on a substrate surface and then excites that adsorbate so as to induce a chemical reaction between the adsorbate and the surface. Polanyi at column 18, lines 2-6. The result of this reaction leaves a pattern on the surface that corresponds to the pre-existent molecular scale pattern of the adsorbate. Polanyi further teaches that the ordering of the adsorbate molecules to form the pre-existent molecular-scale pattern can be due to adsorbate-substrate forces or adsorbate-adsorbate interactions (so-called "SAMs"). Polanyi at column 7, lines 52-57.

The system taught by Polanyi uses Ultra High Vacuum (UHV) and states that this is the reason that "gas-phase dissociation by the irradiation was negligible." Polanyi at column 10, lines 31-33. The Examiner asserts that such a statement in Polanyi "explicitly excludes photolytic decomposition of gaseous precursors occurring." Office Action at page 4, second paragraph. Applicants traverse this position of the Examiner.

Polanyi does not teach this claim limitation. The cited portion of Polanyi does not teach or suggest a significant gaseous atmosphere of any composition, especially an atmosphere that would contain compounds that are susceptible to dissociation, since it uses an ultra high vacuum. The absence of photolytic decomposition is simply a by-product of the completely different apparatus of the Polanyi reference, and does not teach or suggest the claimed limitation, considered as a whole, of claim 1, which states: "wherein the intensity of the optical radiation is insufficient to cause significant

photolytic breakdown of molecules of the donor compound that are suspended in the carrier gas." The Examiner made the rejection by reducing this limitation to simply "excludes photolytic decomposition". This is improper and does not consider the limitation, let alone the claim, as a whole. In the method of Polanyi, there is simply no carrier gas, and therefore no donor compound can possibly be suspended therein, and thus there is no need to limit optical radiation intensity to a level that is insufficient to cause breakdown of the same. The cited aspect of Polanyi simply does not teach or suggest the actual claim limitation, or at the least fails to give consideration to the claim "as a whole."

The Polanyi reference certainly does not teach at least the following claimed features of the present invention, as are included in both independent claims 1 and 23.

> providing a donor compound suspended in a carrier gas, the donor compound including the one or more elements for deposition;
>
> passing the carrier gas with the suspended donor compound over the substrate so as to form a film of the donor compound on the substrate

The Morishige reference is directed to an optical CVD method that uses varying optical intensities during different phases of the deposition process. The process of Morishige starts by forming deposits through a photochemical reaction within the CVD vapor. Morishige does not teach a deposition process using a film of donor molecules or an adsorbed layer on the substrate. Morishige only discusses deposition from a vapor occurring by a photochemical process occurring in that CVD vapor. Morishige at column 7, lines 33-38. This is the exact opposite of the claim limitation of independent claim 1, which recites: "the intensity of the optical radiation is insufficient to cause significant photolytic breakdown of molecules of the donor compound that are suspended in the carrier gas."

Further, the modification of Morishige, which is directed to creating a photochemical reaction in the CVD vapor, to contain this recited feature of the present invention, which excludes photolytic breakdown of suspended molecules, would create

an inoperable system. The Examiner cannot altering the process disclosed in Morishige so as to render it unsatisfactory for its intended purpose or change its principle of operation.

Further, the apparatus of Morishige does not describe a flow rate of gas over the substrate as is present in some of the claimed embodiments of the present invention. Morishige only describes a flow rate through the reaction cell as a "desired flow rate known in the art." Morishige at column 5, lines 4-6. Morishige does not describe any gas flow over the substrate as part of its process. The desired flow rate is possibly set in this example to maintain a certain concentration of elements in the vapor in the reaction cell.

Further, Applicants respectfully assert that Polanyi's teaching of the use of UHV and requirement for an ordered adsorbate make it improper to combine Polanyi with Morishige. Morishige only discusses the use of a CVD vapor in which a photochemical reaction occurs. There is no suggestion in any cited reference to combine the clearly disparate characteristics of the CVD vapor of Morishige and the pre-deposited, ordered adsorbate as required by Polanyi. Additionally, it is improper to use the Applicants' own specification for the hindsight reconstruction of the claimed invention. The Federal Circuit has repeatedly warned against using the Applicants' disclosure as a blueprint to reconstruct the claimed invention out of isolated teachings of the prior art. *See* MPEP §2143; *Grain Processing Corp. v. American Maize-Products*, 840 F.2d 902, 907, 5 USPQ2d 1788, 1792 (Fed. Cir. 1988); In re *Fitch*, 972 F.2d 160, 12 USPQ2d 1780, 1783-84 (Fed. Cir. 1992).

Furthermore, the adaption of the Polanyi reference, which uses pre-existent patterns in an ordered adsorbate to imprint that pattern onto the surface, to use in an embodiment of the present invention, which includes passing the carrier gas with the suspended donor compound over the substrate so as to form a film of the donor compound on the substrate, destroys the intent, purpose and function of the Polanyi reference. The Federal Circuit has consistently held that when a §103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such as proposed modification is not proper

and the *prima facie* case of obviousness can not be properly made. *See* In re *Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

With regard to radiation wavelength, Polanyi does discuss using various radiation sources and notes that UV can be used and that visible light is suitable for "low work-function materials." However, the Polanyi system uses radiation to induce a reaction in the adsorbed material. This actually teaches away from the present invention, in which "the selected radiation has a wavelength for which a film of a few monolayers of donor molecules can be expected to have an exceedingly weak single photon adsorption cross-section." Specification at page 13, lines 18-20.

With regard to claim 1, neither Polanyi nor Morishige, taken alone or in combination, teaches or suggests the following combination of recited features of the present invention.

> providing a donor compound suspended in a carrier gas, the donor compound including the one or more elements for deposition;
>
> passing the carrier gas with the suspended donor compound over the substrate so as to form a film of the donor compound on the substrate; and
>
> irradiating the donor compound with optical radiation having an intensity sufficient to cause deposition of the one or more elements onto the substrate through photochemical decomposition of molecules of the donor compound within the film formed on the substrate,
>
> wherein the intensity of the optical radiation is insufficient to cause significant photolytic breakdown of molecules of the donor compound that are suspended in the carrier gas.

Of particular note, neither Polanyi nor Morishige discusses passing any type of gas over a substrate so as to form a film of the donor compound. This certainly precludes any teaching or suggestion to select a radiation intensity that simultaneously

satisfies the combination of: a) causing deposition onto the substrate through photochemical decomposition of molecules within the film formed on the substrate without b) causing significant photolytic breakdown of molecules that are suspended in the carrier gas, as is recited in claim 1.

With regard to claim 9, the cited references do not discuss the flow of gas over the substrate and do not teach passing the carrier gas over the substrate at a rate that causes it to have a laminar flow over the substrate, as is recited in claim 9. Since these references do not even discuss any flow of a carrier gas "over the substrate" as is recited in claim 9, Applicants respectfully assert that the rejection of claim 9 under 35 U.S.C. §103(a) should be withdrawn.

With regard to claim 10, the cited references do not discuss the flow of gas over the substrate and do not teach passing the carrier gas over the substrate at a rate that causes formation of the film of the donor compound on the substrate that is a few monolayers thick, as is recited in claim 10. Since these references do not discuss any flow of a carrier gas "over the substrate" as is recited for claim 10, Applicants respectfully assert that the rejection of claim 10 under 35 U.S.C. §103(a) should be withdrawn.

With regard to claim 14, the cited references do not teach or suggest the recited features of independent claim 14, of wherein the step of irradiating is performed for a duration that is not long enough to cause thermally induced decomposition of the donor compound, as is recited in claim 14. Applicants therefore respectfully assert that the rejection of claim 14 under 35 U.S.C. §103(a) should be withdrawn.

Additionally, with regard to claim 20, Applicants assert that neither Polanyi nor Morishige, taken alone or in combination with each other, teaches or suggests the following recited features.

flowing a carrier gas in contact with a solid donor compound to generate a mixture of donor compound vapor and carrier gas; and

flowing the mixture over the substrate.

As stated above, these references do not discuss any flow of a carrier gas "over the substrate" as is recited in claim 20. Applicants therefore respectfully assert that the rejection of claim 20 under 35 U.S.C. §103(a) should be withdrawn.

With regard to claims 21 and 22, the cited references do not teach the recited features of flowing the mixture over the substrate at a velocity of at least about 5 or 50 cm/second, as is recited in claims 21 and 22. Since these references do not discuss any flow of a carrier gas "over the substrate" as is recited for these claims, Applicants respectfully assert that the rejection of claim 21 and 22 under 35 U.S.C. §103(a) should be withdrawn.

Further, dependent claims 2-6, 8-14, and 20-22 depend from claim 1 and therefore include all of the limitations thereof. Therefore, claims 2-6, 8-14, and 20-22 are allowable for at least the same reasons described herein for independent claim 1. For at least the above described reasons, Applicants respectfully submit that the rejection of claims 1-6, 8-14, and 20-22 should be withdrawn.

Rejections Under 35 U.S.C. §103(a) as being unpatentable over Polanyi et al.,optionally in view of Morishige, and further in view of Trushin et al.

The Examiner rejected claims 23-25 under 35 U.S.C. §103(a) as being unpatentable over Polanyi et al., optionally in view of Morishige, and further in view of Trushin, et al.

The Trushin et al. reference describes experimental processes using single-photon UV decomposition of metal carbonyl molecules that are in a gas phase in order to discover and characterize the photochemical process by which metal carbonyl molecules are decomposed. *See* Trushin at abstract. Trushin uses short duration laser

pulses to better observe the chemical mechanics that cause the observed reactions. *See, e.g.*, Trushin at 4130 (left column, first full paragraph). This is not consistent with the teachings of the other cited references, nor the purposes of the present invention, which are directed to the disposition of appreciable amounts of material in order to create sizable deposits for practical use in semiconductor fabrication, creation or repair of semiconductor lithography masks, and the like. Neither Trushin nor any other cited reference provides a motivation for using short duration laser pulses for deposition of appreciable quantities of material by a photolytic process.

Further, the adaption of Trushin, which is an experimental apparatus used to observe molecular behavior, so as to create the system of the present invention destroys the intent, purpose and function of the Trushin reference. The Federal Circuit has consistently held that when a §103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such as proposed modification is not proper and the *prima facie* case of obviousness can not be properly made. *See* In re *Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Additionally, none of Polanyi, Morishige or Trushin, taken either alone or in combination with each other, teaches or suggests the following recited elements of claim 21.

> providing a donor compound suspended in a carrier gas, the donor compound including the element for deposition;
>
> passing the carrier gas with the donor compound over the substrate so as to form a film of the donor compound on the substrate; and
>
> irradiating the donor compound with optical radiation so as to cause deposition of the element onto the substrate through photochemical decomposition of molecules of the donor compound within the film on the substrate,

wherein the optical radiation has a pulse width that does not cause thermal absorption by the element so as to prevent thermally induced breakdown of the donor compound.

As discussed above, Polanyi and Morishige do not teach or suggest the recited limitations of providing a donor compound, including the element for deposition, suspended in a carrier gas, and passing the carrier gas with the donor compound over the substrate so as to form a film of the donor compound on the substrate. Trushin also fails to teach or suggest these recited features.

Further, there is no mention in these references, or even a citation by the Examiner of a teaching by these references of the following recited feature.

wherein the optical radiation has a pulse width that does not cause thermal absorption by the element so as to prevent thermally induced breakdown of the donor compound.

For reasons discussed above for the limitations of independent claim 23 that are common with independent claim 1, the cited references do not teach or make obvious the invention claimed by independent claim 23, when it is considered as a whole. The Applicants therefore respectfully assert that the rejection of claim 23 under 35 U.S.C. §103(a) should be withdrawn.

The Examiner asserts that "Polanyi et al. teaches the irradiation process is a femtoscale process." Office Action at page 5, third paragraph. However, this mis-characterizes the cited portion of Polanyi. The Polanyi reference only discusses the time-scale of the dissociation reaction, not the irradiation process as asserted by the Examiner. Polanyi, in fact, is describing an exchange reaction wherein dissociated Cl (chlorine) is never present as a free atom, but is part of an exchange reaction. Polanyi at column 13, lines 21-26. The time-scale of such chemical reactions is well known,

and neither Polanyi nor any other cited reference ever discusses or suggests using such short time periods as an irradiation time for a deposition process. The use of such short irradiation times is counter to the intent of causing appreciable deposition of material onto the substrate. In contrast to what is asserted by the Examiner, Polanyi actually states that its process uses laser pulse widths from nanoseconds (10^{-9} s) to picoseconds (10^{-12} s). Polanyi at column 4, lines 45-47. This certainly does not provide any motivation to use a shorter pulse, and even teaches away from using shorter pulses, such as the femtosecond (10^{-15} s) pulses recited in dependent claims 24 and 25.

The only document that discusses the use of laser pulses with sub-picosecond durations is the Applicants' specification. As discussed above, the suggestion to use sub-picosecond laser pulses, as is recited in claims 24 and 25, can not come from the applicants' own specification. *See* MPEP §2143; *Grain Processing Corp. v. American Maize-Products*, 840 F.2d 902, 907, 5 USPQ2d 1788, 1792 (Fed. Cir. 1988); In re Fitch, 972 F.2d 160, 12 USPQ2d 1780, 1783-84 (Fed. Cir. 1992).

Furthermore, claims 24 and 25 depend from independent claim 23 and therefore include all of the limitations thereof. Therefore, claims 24 and 25 are allowable for at least the same reasons described herein for independent claim 23. For the above described reasons, the Applicants respectfully submit that the rejection of these claims should be withdrawn.

Rejections Under 35 U.S.C. §103(a) as being unpatentable over Polanyi et al. alone or in view of Baum et al.

The Examiner rejected claim 7 under 35 U.S.C. §103(a) as being unpatentable over Polanyi et al., optionally in view of Morishige, and further in view of Baum et al., and optionally further considering Baum et al. '206. Claim 7 depends from independent claim 1. As dependent claim 7 includes all of the limitations of the independent claim from which it depends, claim 7 distinguishes over Polanyi and Baum as well for at least the reasons described above with respect to claim 1, and therefore Applicants respectfully submit that this rejection should be withdrawn.

In view of the foregoing, it is respectfully submitted that the application and the claims are in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is invited to call the undersigned attorney at (561) 989-9811 should the Examiner believe a telephone interview would advance the prosecution of the application.

Respectfully submitted,

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